

# PATENT SPECIFICATION

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## (54) IMPROVEMENTS RELATING TO INFLATABLE IMPACT-ABSORBING PROTECTORS

(71) I, PETER WILLIAM BOTHWELL, a British Subject of "Meoncote", 114 Shipston Road, Stratford-upon-Avon, in the County of Warwick, do hereby declare the invention, for which I pray that a Patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to inflatable impact-absorbing protectors which are worn as head gear or body garments by persons riding on or in vehicles and which are inflated in the event of a crash to provide protection against impacts.

In particular, the invention is concerned with a protector of the kind, hereinafter referred to as the kind specified, comprising at least one deformable, normally deflated chamber, e.g. an air bag, means operable to inflate the chamber and control means adapted to detect the imminence or occurrence of a crash and thereupon to operate the inflating means.

The invention has been devised primarily in connection with protectors worn by motor cyclists and riders of other two wheeled vehicles and for convenience the following description will be confined to this application of the invention. However, it is to be understood that there is no limitation in this regard since the invention is also applicable to protectors worn by persons travelling in motor vehicles such as cars, and aircraft.

The invention is applicable, for example, to head protectors and head, neck and chest protectors embodying the invention forming the subject of my Patent Application No. 14995/74 (Serial No. 1,519,771). According to this Application there is provided a head protector comprising a rigid structure for fitting to a wearer's head and one or more inflatable bags carried by the rigid structure in a deflated condition and connected or connectible to means for inflating the bag or bags, the bag or bags being arranged, when

inflated, to form, externally of the rigid structure, an impact-absorbing cushion which envelops substantially the whole of the wearer's head.

In another example, the present invention is applicable to body protectors embodying the invention forming the subject of my U.K. Specification No. 1,479,733. In this specification there is claimed a protective garment for cushioning the wearer against impact and adapted to be fitted to the body of the wearer, said garment having a plurality of deformable chambers to contain fluid thereby to provide impact-absorbing cushion covering different parts of the body, the chambers each having a normally closed venting means adapted, in the event of an increase in the pressure of fluid in the chamber above a predetermined value resulting from an impact against the garment, automatically to open and to permit the escape of fluid from the chamber at a controlled rate.

In yet a further example, the present invention is applicable to body protectors embodying the invention forming the subject of my U.K. Specification No. 1,503,483. According to this specification there is provided a shock absorbing means which comprises a relatively long and narrow tube means divided longitudinally into a continuous series of relatively short deformable chambers to contain fluid, each adjacent pair of chambers in the series being interconnected at their adjoining ends by a fluid flow restrictor adapted in the event of an increase in the pressure of fluid in either one of the said pair of chambers, to permit fluid to flow from the said chamber into the other chamber at a controlled rate, whereby in the event of any one of the chambers in the series being subjected to a shock resulting in an increase in the pressure of fluid therein fluid flows from the chamber into the adjacent chamber or chambers and thence into the next chamber or chambers in the series and so on, whereby the energy

of the shock is absorbed by a controlled directional flow of fluid along the series of chambers.

5 In a known form of inflatable impact-absorbing protector of the kind specified designed to be worn by a motor cyclist the control means is mounted on the motor cycle and the inflating means comprises a gas cylinder which is also mounted on the motor cycle. The gas cylinder is connected to the protector by a supply line which has a plug-in connection to the protector, the arrangement being that the supply line is pulled away from the protector in the event of the rider being thrown from the motor cycle in a crash. This known arrangement has the disadvantage that the motor cyclist has to plug the supply line into the protector each time he mounts the motor cycle and to disconnect the supply line when he dismounts. The supply line connected between the gas cylinder and the protector may also affect the rider's freedom of movement.

15 The object of the present invention is to provide an improved form of inflatable impact-absorbing protector of the kind specified which, in particular, overcomes the above disadvantages when used by motor cyclists.

20 According to the present invention I provide an inflatable impact-absorbing protector of the kind specified wherein the control means includes an emitter adapted to emit a signal when the imminence or occurrence of a crash is detected, and the inflating means includes a receiver which is adapted to receive such a signal and thereupon to operate the inflating means thereby to inflate the chamber or at least one of the chambers of the protector, the transmission of the signal from the emitter to the receiver being effected without any physical connection therebetween.

25 When the invention is applied to a protector worn by a motor cyclist, the inflating means with the receiver may be carried by the protector and the control means with the emitter may be mounted on the cycle, and since there is no physical connection between the control means and the inflating means, there are none of the problems which arise from the use of a supply line as in the known arrangement described above.

30 The emitter may be adapted to emit a signal in the form of electro-magnetic radiation, for example heat waves, light waves or radio waves, or a signal in the form of sound waves, for example a hypersonic signal, the receiver being adapted to receive a signal of the same form.

35 Preferably the emitter is adapted to emit, and the receiver is adapted to receive, signals in the form of radio waves. Thus both

the emitter and the receiver may have solid state electrical circuits.

The inflating means preferably comprises a solid fuel pyrotechnic gas generator operable by an electric igniter, the receiver being arranged, when it receives a signal from the emitter, to operate the electric igniter which then ignites the fuel so that the gas generator supplies gas to the chamber or chambers of the protector and thereby inflates it or them. A solid fuel pyrotechnic gas generator can be carried by the protector itself, which is especially convenient in the case of a protector to be worn by a motor cyclist.

40 In another arrangement, applicable to protectors to be worn by persons travelling in motor vehicles or aircraft, the inflating means may include a gas cylinder mounted on the motor vehicle or aircraft and connected by a supply line to the protector, inflation of the latter being controlled by a normally closed valve incorporated in the supply line and openable by means of a pyrotechnic device or squib arranged to be fired by the receiver which is mounted on the vehicle or aircraft so as to receive signals emitted by the emitter which is mounted at a remote position in the vehicle or aircraft.

45 A protector may have two or more inflatable chambers and in this event the chambers may have a common inflating means operable by a single receiver or individual inflating means operable by a single common receiver or individual receivers. Where there are two or more receivers they may be operable by a single control means having one emitter. A single control means having one emitter may also be used to control the operation of a number of protectors, for example where protectors are worn by all the occupants of a motor motor vehicle or aircraft.

50 The means for detecting the imminence or occurrence of a crash may comprise an inertia or "G" level sensor of a known form mounted on the vehicle, for example on one of the forks carrying the front wheel of a motor cycle, and arranged when it detects excessive acceleration or deceleration forces, for example 6G, to cause the emitter to emit a signal.

55 The emitter and the receiver may include warning lights to indicate whether or not they are operative.

60 Where the protector is designed for use by a motor cyclist and is controlled by radio signals, it may be necessary to provide certain safeguards. In order to prevent the inflating means of protectors worn by other motor cyclists in the vicinity being operated by the signal emitted by the emitter in a crash, the emitter may be adapted to produce radio waves which are effective only in the immediate vicinity of the motor

cycle and are directed upwards in a narrow beam towards the receiver, the emitter being mounted for example on the steering head of the motor cycle. Alternatively, or in addition the receiver may be adapted to respond only to signals of a predetermined frequency emitted by the emitter. In the latter regard to enable different riders to use a particular motor cycle, means may be provided for changing the frequency of the signals emitted by the emitter. These means may have associated therewith a combination barrel lock to facilitate adjustment and setting of the signal frequency required for a particular protector.

The invention will now be described by way of example with reference to the accompanying drawings, in which:—

FIGURE 1 is a diagrammatic side view of a motor cycle with a rider seated on it and wearing one form of head, neck and chest protector embodying the invention;

FIGURE 2 is a block diagram showing the electrical circuit of the control means of the protector, and

FIGURE 3 is a block diagram showing the electrical circuit of one of the inflating means of the protector.

In the drawings a motor cyclist is shown wearing a head, neck and chest protector 10 of the form illustrated in Figure 1 of the drawings accompanying the Complete Specification of my Patent Application No. 14995/74. (Serial No. 1519771).

This protector basically comprises a rigid outer structure 11 having a head section formed to enclose the motor cyclist's head a neck section formed to surround the cyclist's neck and a chest section formed to extend over the upper part of the cyclist's chest and back and to engage the cyclist's shoulders so that the weight of the protector is borne by the cyclist's trunk. The structure incorporates a transparent part 12 at the front thereof for the cyclist to see through. The head section of the structure contains a helmet 13 for fitting on the cyclist's head and having a part-spherical outer surface engaged with a part-spherical inner surface of the head section, this ball and socket engagement of the helmet with the structure permitting universal turning movement of the helmet relative to the structure.

Attached to the external surface of the structure 11 are two inflatable bags 14 and 15. These bags are stowed in a deflated condition flat against the external surface of the structure as shown, and are arranged when inflated completely to envelop the structure thereby providing an impact-absorbing cushion around the head, neck and chest of the wearer and also over the face. The two bags 14 and 15 are inflatable by means of two solid fuel pyrotechnic gas generators 16 and 17 respectively, which are

embedded in the structure 11. The gas generators are operable by respective electric igniters arranged, when supplied with an electrical current, to ignite the fuel of the generators so that the latter supply gas to the bags and thereby inflate them.

The motor cycle has mounted on it a control means including means for detecting the imminence or occurrence of a crash and an emitter adapted, when the imminence or occurrence of a crash is detected, to emit a radio signal, and the electric igniters of the gas generators 16 and 17 have associated therewith receivers which are adapted to receive such a signal thereupon to cause electrical current to be supplied to the electric igniters thereby to effect inflation of the bags.

The control means is illustrated diagrammatically at 18 in Figure 2. The means for detecting the imminence or occurrence of a crash comprise an inertia sensor 19 which is mounted on one of the steering forks of the front wheel of the motor cycle and, when it detects excessive acceleration or deceleration forces which occur before or in a crash, operates the emitter 20. This emitter is mounted on the steering head carrying the front wheel forks of the motorcycle and, when operated, emits a radio signal which is directed upwards in a narrow beam R towards the structure 11 worn by the motor cyclist. The control means 18 includes a power supply 21 which may be the battery of the motor cycle. the inflating means of each bag 14, 15, is illustrated diagrammatically at 22 in Figure 3. This Figure shows the receiver 23 which picks up a radio signal emitted by the emitter 20 and thereupon operates a switching circuit 24 to cause electrical current to be supplied from a power supply 25 to the igniter 26 of the bag 14, 15 concerned.

A single power supply 25 may be provided for the two inflating means of the two bags. The emitter and the receiver have solid state electrical circuits.

The receivers may be adapted to respond only to signals of a predetermined frequency emitted by the emitter, and means may be provided for changing the frequency of the signals emitted by the emitter.

#### WHAT I CLAIM IS:—

1. An inflatable impact-absorbing protector of the kind specified wherein the control means includes an emitter adapted to emit a signal when the imminence or occurrence of a crash is detected, and the inflating means includes a receiver which is adapted to receive such a signal and thereupon to operate the inflating means thereby to inflate the chamber or at least one of the chambers of the protector, the transmission of the signal from the emitter to

the receiver being effected without any physical connection therebetween.

2. A protector as claimed in Claim 1 for use by a motor cyclist, wherein the inflating means with the receiver is carried by the protector and the control means with the emitter is mounted on a motor cycle.

3. A protector as claimed in Claim 1 or Claim 2, wherein the inflating means is adapted to emit, and the receiver is adapted to receive, signals in form of radio waves.

4. A protector as claimed in Claim 1, 2, or 3, wherein the inflating means includes a solid fuel pyrotechnic gas generator operable by an electric igniter, the receiver being arranged, when it receives a signal from the emitter, to operate the electric igniter which then ignites the fuel so that the gas generator supplies gas to the chamber or chambers of the protector and thereby inflates it or them.

5. A protector as claimed in any one of the preceding claims which has two or more inflatable chambers, wherein the chambers have individual inflating means operable by individual receivers which are in turn operable by a single control means having one emitter.

6. A protector as claimed in any one of the preceding claims, wherein the means for detecting the imminence or occurrence of a crash comprise an inertia sensor arranged when it detects excessive acceleration or deceleration forces, cause the emitter to emit a signal.

7. A protector as claimed in Claims 2 and 3, wherein the emitter is adapted to produce

radio waves which are effective only in the immediate vicinity of the motor cycle and are directed upwards in a narrow beam towards the receiver, the emitter being mounted for example on the steering head of the motor cycle.

8. A protector as claimed in Claims 2 and 3 or Claim 7 wherein the receiver is adapted to respond only to signals of a predetermined frequency emitted by the emitter.

9. A protector as claimed in Claim 8 wherein means are provided for changing the frequency of the signals emitted by the emitter.

10. A protector as claimed in any one of the preceding claims, wherein the or each inflatable chamber comprises an inflatable bag carried in a deflated condition by a rigid structure for fitting to a wearer's head, the bag or bags being arranged, when inflated, to form, externally of the rigid structure, an impact-absorbing cushion which envelops substantially the whole of the wearer's head.

11. A protector substantially as herein described with reference to and as illustrated in the accompanying drawings.

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